

# The Future of VMT



# Ongoing work on VMT

- Currently revising the data import routines to include data from other manufactures as well as general velocity scatter data (e.g. ADVs, model output, etc.)
- Revisiting the transect averaging routines to allow for dynamic bins size data (triangulation approach)
- Working on ability to plot sections in 3-D with contouring and vectors
- Working on generating panel plots from multiple cross sections with common scaling

# Ongoing work on VMT

- **As we revise code, we are rewriting from the ground up using Object-Oriented programming**
  - **Should improve performance and stability**
  - **Should allow easier expansion of the code**
- **We will also be working with Mathworks directly to provide feedback on improvements to the code**

# List of VMT Updates

List of 47 requested updates is on your flash drive (As of March)

Work progresses as time And funding allow

User community can help expedite the improvements

Prioritized List of VMT Improvements (as of March 27, 2012)						
Task	Importance Class	In-class Priority	Type	Responsibility	Status	Comments
Add generic input capabilities	High	10	Accessibility	PRJ		Can be done in conjunction with dynamic cell size work. Envision a standard generic data import format and several "receivers" for RD, Sonotek, etc.
Add dynamic cell/bin size data handling	High	10	Accessibility	FE	In progress	Working with Matt on this one.
Add temporal averaging to ASCII2GIS utility	High	10	Functionality	PRJ	Done	Now allows for a user-specified averaging interval (really helps knock down the noise). Averages after completing the depth- or layer-average.
Update multibeam bathy comp to include M0, S5, and RiverRay data	High	10	Accessibility	PRJ		Believe DSM has done this for ADMAP, will need to check. Code will have to distinguish data set as routines are slightly different for Sonotek. Would be nice to have beam angle auto detected.
Look into issue with TePlot primary velocity (sign convention)	High	10	Bug Fix (?)			Request from Ricardo. He mentioned the sign is flipped in the Teplot output. Need to check if that was the way for (floating convention)
Improve 2-D interpolation of data on mean cross section (normalize, triangulate and then interpolate to regular 2-D grid)	High	10	Functionality	FE	In progress	Working on implementation of this one.
Determine how to handle multiple frequencies and backscatter	High	10	Functionality			Requires some thought to handle the dynamic switching on M0
Improve efficiency	High	9	Functionality	PRJ/Mathworks	In progress	Getting consulting
Improve memory usage	High	9	Functionality	PRJ/Mathworks	In progress	Getting consulting
Determine how to better integrate extensions	High	9	Accessibility	PRJ/Mathworks	In progress	Getting consulting
Add IIRIC bathy export compatibility	High	9	Import/Export	PRJ	In progress	I have worked up some code, but not yet implemented it
Add IIRICANV file export for plan view data	High	9	Import/Export	PRJ	Testing	Currently included in the code, but turned off pending testing
Improve error handling to provide feedback for EXE users	High	8	Functionality			Some errors are not caught and EXE can simply stop. Need to ID these errors and provide feedback to the user. Matlab users can check the command window for feedback. Example error is file missing from a corrupted ASCII file.
Improve GPS filter	High	8	Functionality			Have noticed some poor performance of the filter that replaces GPS with BT when GPS is bad. Can include outlier GPS points (MLTPATHS). Currently only removes flagged GPS data. Need a proximity condition (distance moved in unit time) to screen for jumps and remove points. It must not remove data that is good, but has intermittent GPS.
Start using version control software	High	8	Management			Highly recommended given the development work from multiple parties
Develop better autocalling routines to give better visualizations on first run (users and tune-in best results from there)	High	7	Output/Visualization			Would produce better visualizations off the bat. If routine is robust enough, might consider removing some of the manual manipulation users are accustomed.
Improve the figure export capabilities (add EPS option, format for USGS pubs, Remove titlebar, add axis to colorbar, etc.)	High	6	Output/Visualization	PRJ		Simple improvements to the clarity and composition of the figures to make them more presentable for publications.
Allow variable WSE file for bathy	High	5	Functionality	PRJ	Testing	implemented in original code, but not fully tested to ensure it is working properly.
Investigate vertical velocity negative bias	High	4	General Issue			Vertical velocities for DSMs show a negative bias. Rooted by effects: flow disturbance, and beam averaging routine are suspected. Can we understand this more using data and possible allow for users to correct for this bias in VMT. DSM has code for this. Currently VMT reads GPS from the ASCII file. This is nice because DSM has code for this. Currently VMT reads GPS from the ASCII file. This is nice because the ASCII file is needed, but can lead to multiple ensembles having the same coordinates if GPS update rate is low. Some implemented what he has to handle Sonotek data too.
Update GPS script to pull nav file rather than rely on ASCII positions	Medium	10	Functionality			Easy to implement, suggested by a few, makes sense.
Build-in threshold/filter for data to remove data far away from the mean cross section	Medium	10	Functionality			DSM has this script, need to identify how to implement these in VMT. Would be nice to be able to turn on and off QAVC screening to see the difference in the data.
Add QA/QC routines	Medium	10	Functionality			Implemented in a custom version of VMT
Add vorticity computation	Medium	10	Functionality	FE	In progress	Implemented in a custom version of VMT
Improve batch processing capabilities (allow input of a processing file that has all transect groupings and settings)	Medium	10	Functionality			This feature would allow users to move through (or reprocess) large data sets without going cross section by cross section. The setup file would automatically interface with VMT and loop through the data. Turn with button in the interface.
Allow fixed color scales and vector scales	Medium	9	Output/Visualization			Necessary for publications in which the user wants to keep the scales constant between plots and cross-sections.
Integrate stationary extension	Medium	9	Extension	JB/PRJ/C		I built this code a ago. Need to figure out how best to interface it with VMT and then test it. He has done some testing with Jon Cabot. The "advanced processing" button could be used here to query this extension. Could also add a stationary data check box to the data import panel that opens JB's gui.
Improve routines for estimating shear velocity and bed shear stress from moving boat data (and stationary data)	Medium	9	Extension			I have code and it seems to work well in most cases, but not always. It needs some work to improve robustness. Also need a gui with selection of methods for computation (profile fitting, slope method, etc.) and parameters (portion of the profile to fit, roughness height if necessary, etc.). Not all methods work in all cases and the results can widely vary. Need discussion on output.
Add option to interpolate missing data	Medium	9	Functionality	FE	In progress	implemented in a custom version of VMT (FE). Need to be careful, interpolating small amounts of data is probably ok, but filling large patches of missing data will add to errors. Can we alert the user when a threshold is exceeded regarding percentage of cross section interpolated or larger area interpolated?
Improve handling of edge data (missing data at edges and top and bottom can cause loss of additional data during averaging)	Medium	9	Functionality			Current averaging and interpolation script cause an additional loss of data at the edges of the measured data bounds. This can be improved and I have tried other schemes, but never been happy with the results.
Add capabilities to develop/input calibrations for suspended sediment	Medium	8	Extension			This extension would allow a user to develop or input a SS calibration to compute SS from backscatter. Requires a corrected backscatter first. Issue with applicability of calibration for other reaches and the temporal stability of calibration for the site (i.e. does the calibration change with time due to changes in sediment characteristics?)
Add corrections for backscatter (sediment and water adsorption, etc.)	Medium	8	Extension	JB	In progress	Correct backscatter in preparation for computation of SS. Even without SS calibration, provides a better representation of SS. Procedures exist, need to code up and implement. Justin has done this for stationary data.
Improve reachwise plotting capabilities including 3-D display of multiple cross sections	Medium	7	Output/Visualization			Much like the plan view plot with multiple cross sections, this would provide a 3-D display of all selected cross sections on common scales. Currently people build these plots using the Teplot output.
Improve GIS export capabilities (output shapefiles of bathy points, velocity vectors)	Medium	7	Import/Export			Go beyond ASCII files and generate Shapefiles directly. Should not be too hard, but more complicated for vectors rather than points.
Improve Google Earth Export (export velocity vectors-- both plan view and cross-section-- to GE)	Medium	7	Import/Export			improve GE export to include vectors and 3-D data. Note: Not sure if this is possible given all data lie below the image plane in GE.
Add data editor tool to allow removal of outliers	Low	10	Functionality			I have such a data editor tool (select and remove graphically), but need to implement it in VMT. I envision users being able to select the tool and remove bad vectors, this cleaning up a data set. Regenerative plots would maintain the omission (will be tricky with spatial averaging).
Add bed velocity computation following Rennie	Low	10	Extension			Should be straight forward to implement, but requires both the ASCII with BT and and ASCII with GPS ref. I envision a button for this computation (perhaps in the advanced processing tools) and it querying the user for an additional ASCII file. It would then compute a point coverage for bed velocity and then... grid it to make a surface (could be problematic to make robust?)
Add uncertainty computation for bathy data (for obliques)	Low	9	Extension			I have code for this for single beam data, should be straight forward to add for strip data. Requires the user to provide the survey data and oblique data and then performs a search for coincident points and uses the methods of Wilson et al. to compute the uncertainty
Improve routines for estimating longitudinal dispersion coefficient	Low	9	Extension			Biggest improvements can be made in the computation of shear velocity. Needs to query user for method of estimation (moving boat, stationary, slope, etc.)
Add TIN and contour generation for bathymetry and allow use as a background for velocity data (currently requires users to TIN and contour outside of VMT and import as background)	Low	8	Output/Visualization			Code exists, but robustness can be a problem. Need to have user interaction and this opens a can of worms. Would be nice to have a few can data a scheme that produces good results with little user interaction. In addition, disclaimers would be necessary. Scripts exist, but not currently implemented. Cabot did some work for the stationary data from the Mississippi/Missouri confluence that could help. Need to scale the in-stream velocity relative to the vertical velocity also vertical component is very difficult to use in the vector field. Otherwise, very similar to the cross section plots. Need to think about how to handle channel curvature (don't want to map to a straight line)
Develop handling of longitudinal data	Low	7	Extension			Just a thought: If one has QW data collected throughout the survey and the clocks are synced with the computer, then the GPS from the ADCP can be used to georeference the QW data. I have code that does all this, but not in VMT. Would be a nice extension as the QW data is useful especially as evidence for visualizing the flow over a rocky surface (data)
Add water quality import capability (YSI) or other import with GeoRef from ADCP GPS using timestamp)	Low	6	Extension			Just a thought: If one could select multiple components of velocity or multiple methods of secondary flow computation and all are plotted in the same figure in separate panels, this would improve analysis. Would require multiple subplots for data selection (maybe the user can turn one on and another window appears with the sets of sub boxes (3 plots max). Also need to then implement a plotting loop in the plotting function.
Allow multiple plots to be generated simultaneously (by selecting more than one parameter and using subplot)	Low	5	Output/Visualization			Has been done, but leaves room for improvement with regard to accuracy and robustness. Would also require a stationary bed (can require a moving bed test and process the results and only processed if the flow is moving bed). Also requires the user to enter the start point for each transect.
Add capability to process data without GPS	Low	5	Accessibility			Is there a better, more robust, way to do this? Currently saves the last path to the location as file in the VMT directory. The EXE does not do this for some reason. Perhaps has to do with using relative path names?
Fix the path saving option in the EXE file (does not save last path). Works (on my machine) in the Matlab version.	High	10	Functionality			

# Feedback

- **Your feedback is important**
  - **What is missing from VMT?**
  - **What can be improved?**
- **Suggested improvements will be noted and included (if possible) in future versions**

# Release of VMT

- Full release of executable and source code once paper is accepted and published online
- Initial limited release to volunteers (beta testers) for use and evaluation
- Users are encouraged to post questions and issues on the VMT forum
  - Child board of the OSW Hydroacoustics Forum

# Thank You

- ...for your interest in the class
- ...for your feedback on VMT
- ...for your patience during ongoing improvement of VMT